

HUMANITY'S JOURNEY TO INTERSTELLAR SPACE

INTERSTELLAR

— P R O B E —

Interstellar Probe Exploration Workshop

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Probing the Zodiacal Foregrounds and the Cosmic Backgrounds

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Science Questions

INTERSTELLAR
PROBE

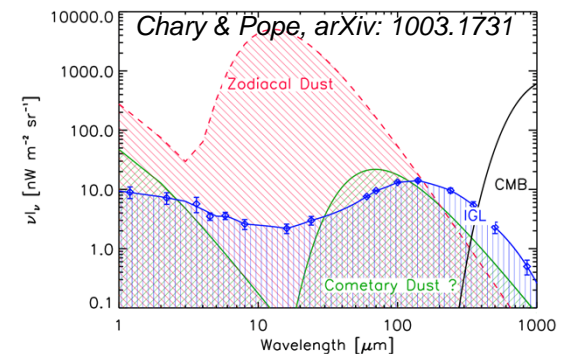
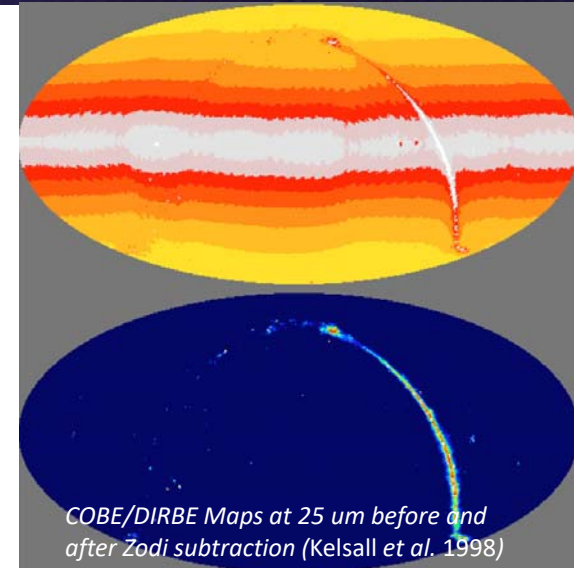
- **Science Target**

- A precise measurement of the optical, near-infrared and far-infrared sky brightness at wavelengths between 0.5 and 200 microns since it is uncertain by factors of 2-3.

- **Science Questions**

- What is the contribution to the total sky brightness from first light galaxies (optical/NIR)?
- What is the contribution from dust obscured star-formation and accretion activity to the sky brightness (FIR) ?
- Is there a contribution from Oort cloud and Kuiper belt dust in the outer solar system to the sky brightness (optical-FIR) ?
- What is the relative contribution of asteroidal and cometary dust to the total zodiacal emission (MIR spectroscopy)?

- **These measurements can only be obtained from a location beyond the asteroid belt since the local zodiacal emission outshines these sources by factors of 100-1000.**



- **Measurement approach**

- The goal is to measure the sky brightness in between stars, but including the regions that consist of galaxies.
- Ideally, the instrument would take images of the entire sky at these wavelengths as a function of heliocentric distance. However, the data volumes are likely to be prohibitive in which case it is optimal to image $\sim 10 \times 1$ square degree fields (spanning ecliptic latitude) with high quality ancillary data.

- **Measurement requirements and Instrument concept**

- At optical/NIR and FIR wavelengths, a $\lambda/\Delta\lambda$ of 3-5 (e.g. ZEBRA; PI: J. Bock)
- At mid-infrared wavelengths (5- 30 microns), a $\lambda/\Delta\lambda$ of 20
- Diffraction limited spatial resolution with a 10-20 cm class telescope
- Field of view of >0.5 square degree
- Cold shutter to measure the dark current and instrumental background

- **Mission requirements for measurements**

- Heliocentric distances of >5 -50 AU
- Data bandwidth (5 TB per band for an all sky survey, 30 MB per field per wavelength for targeted fields)
- Active cooling for MIR/FIR instruments (~ 100 mK), passive cooling for optical/NIR (~ 80 K).

- **Data products**

- Calibrated images as a function of wavelength

Basic Instrument Parameters

Parameter	Current Best Estimate/Comments
Mass (kg)	10 Kg for optical/NIR payload only
Volume (cm)	20*20*30 for optical/NIR, study needs to be done for MIR/FIR
Power (W)	20W for optical/NIR
Thermal Requirements	80K detectors for optical/NIR, 100mK for FIR
Data Volume	5 TB per band for an all sky survey in one band, 30 MB per field per wavelength
Current TRL	High TRL (>6) except for high bandwidth downlink from R>5 AU
Duration of Experiment	Intermittent observations during a multi-year cruise phase
Other	Well baffled telescope